

REMARKS

A Request for a One (1) Month Extension of Time pursuant to 37 CFR 1.136 (a) and (b) is attached hereto.

The above-captioned patent application has been carefully reviewed in light of the final Office Action to which this Amendment is responsive. Claims 1, 7, 10, 11, 14-17, 24-27, 39, 45, 46, 48, 50, 54, 57, 60, 69, 78, and 85 have been amended in an effort to further clarify and distinctly describe that which is regarded as the present invention. Claims 2, 3, 6, 44, 51, 52, and 53 have been canceled without prejudice. To that end, it is believed no new matter has been added.

Claims 1-86 are pending in the above-captioned application, of which Claims 4, 41-43, 47, 49, 80-82, 84 and 86 were previously withdrawn due to a Restriction Requirement. Each of the above elected claims have been rejected in light of certain prior art. Applicants' herein respectfully request reconsideration based on the amended claims and the following discussion.

As to the particular prior art rejections that have been made, Claims 1, 2, 5, 8-10, 50-51 and 55-57 have been rejected under 35 USC §102(b) as being anticipated by Takahashi (U.S. Patent No. 5,522,789), Claims 3 and 52 have been rejected under 35 USC §103(a) as being unpatentable over the combination of Takahashi and Greenberg (U.S. Patent No. 5,592,328), Claims 6 and 53 have been rejected based on the combination of Takahashi, Greenberg and Sakiyama et al., (U.S. Patent No. 6,063,023), Claims 7 and 54 have been rejected based on the combination of Takahashi, Greenberg and Miyano et al. (U.S. Patent No. 5,840,014), Claims 11-13, 15-30, 39-40, 44-46, 48, 58-70, 75-79, 83 and 85 have been rejected based on the combination of Takahashi and Sakiyama et al., Claims 14, 31-34, 36-38 and 71-74 have been rejected based on the combination of Takahashi, Sakiyama et al., and Hori et al (U.S. Patent No. 6,191,809B1) and finally, Claim 35 has been rejected based on the combination of Takahashi in view of Sakiyama et al., and Hori et al., and further in view of Ko (U.S. Patent No. 5,710,428).

Prior to a discussion of the prior art references, Applicants would again like to briefly summarize the novel contributions that have been made as a result of the present invention. That is, Applicant has provided a device for viewing an object stereoscopically with a probe, such as for an endoscopic or borescopic apparatus, that includes image splitting means for splitting a single incoming image of an object into first and second adjacent stereo image parts. Each image part contains

the single image which is then focused onto a single electronic imager using a single optical axis into stereo image parts. The image splitting means according to amended Claim 1 is preferably a refractive prism. With this approach, a single lens train carries both the first and second stereo image parts with substantially no "image mixing" between the first and second adjacent image parts as produced onto the single imager. Moreover, no shielding plate or similar means are required to prevent overlapping or mixing of the images onto the imager. In fact, with approaches that use separate lens trains for the stereo image parts, such as described by Takahashi et al., such shielding plates are absolutely essential otherwise there would be considerable overlap onto the electronic imager. The above configuration wherein a single image is split as described is useful in that it provides compactness which is essential for a probe for a remote inspection device, such as an endoscope or borescope. This advantage has been noted by the Examiner, but is not the only reason for providing the present system. In summary, the advantages of the herein described single lens train configuration over previously known multiple lens train configurations include more compactness, inherently converging optical paths, better left/right image consistency because both images pass through the same lenses instead of different lenses with slightly different characteristics, no shielding is required between the stereo image parts to prevent mixing of the image parts on the imager, more usable image is provided; that is, no areas are blocked out by shielding, just a narrow blur might be found where the image parts meet, lower manufacturing cost due to smaller lens count and simpler lens housings and therefore simpler manufacturing assembly including simpler and more consistent optical alignment.

Moreover, Applicants provide additional features within their present system as claimed herein which has not been fully appreciated by the Examiner. For example, Applicant further provides "zoom windows" in their display wherein portions of the first and second image parts are shown at a greater magnification simultaneously with the remaining images, enabling enhanced inspection capability without a loss in perspective. According to another feature of the present invention, Applicant has provided for the refractive prism to be contained within a detachable distal tip of the probe wherein the removal of the distal tip does not prevent operation of the apparatus. That is to say, the distal tip that produces the stereoscopic effects described herein can be used as an accessory. According to yet another feature of the present invention, the device includes measuring means for

comparing parameters of the first and second stereo image parts in order to determine measurement data and in which an optical characteristic data set is used by the measuring means to determine the measurement data.

The device can be suitably adapted for receiving one of a plurality of detachable distal tips in which each of the detachable distal tips includes a corresponding optical characteristics data set and in which data determined from an image can be used to select which optical characteristics data set corresponds to the detachable tip placed onto the probe. Calibration means can be used for generating the optical characteristics data set wherein the calibration means includes a plurality of object target points which appear in each of the first and second stereo image parts when viewed by the probe. The plurality of object target points comprise at least two object target points with a known spacing therebetween at a first object distance and at least one object target point at a second object target distance. Means are further provided for determining automatically the detection and identification of the plurality of object target points. The calibration means can include using a reflection of illumination of at least one known object target distance.

Still additionally, the device can store the optical characteristics data set(s) into non-volatile memory in each probe and preferably along with the first and second image parts in a single data file. The device can include means for adjusting the optical characteristics data set to increase the accuracy thereof, for example, when a distal part of the probe is operated in a medium that has an index of refraction which is different than that of air.

The measuring means can further include matching means for automatic matching of a user designated point on the object being viewed in a first image part that corresponds to a point on the second image part. If the position of the user-designated point changes, then automatic matching means dynamically and automatically (e.g., without user intervention) occurs with the second image part. The automatic matching means can include global alignment means for performing a global alignment of the first and second image parts automatically wherein regional horizontal and vertical shifts can be determined. Moreover, and advantageously, correction by a user of an incorrect match automatically causes the global alignment means to be utilized.

With the preceding background, Applicants' herein traverses the prior art rejections as follows:

Turning first to the Section 102 rejection and order to successfully anticipate under the Patent Statute, each and every claimed limitation must be found in the cited art. Those limitations that are not found must be notoriously well known in the prior art to one of sufficient skill in the field of the invention. Applicants' have now combined the subject matter of Claims 2, 3 and 6 into Claim 1 and further added the subject matter of Claims 51, 52 and 53 into amended Claim 50. Claims 2, 3, 6, 51, 52, and 53 have now been canceled. To that end and based on the above amendments to independent Claims 1 and 50, it is respectfully submitted that the above anticipation rejection based on Takahashi '789 is now moot and should be withdrawn.

Turning now to the Section 103 rejections, and to maintain a "*prima facie*" obviousness rejection under the Statute, each reference (either singly or in combination), must teach or suggest the essential features of the claims. Those features not taught or suggested must be notoriously well known in the prior art to one of ordinary skill. Furthermore, there must also be a motivation which is found in the prior art as a whole in order to effectively combine the references. This motivation cannot result from a piecemeal combination of features in an effort to duplicate the invention as a result of hindsight (e.g., advance knowledge), but rather must result from an overall teaching of the references, taken in their entirety, at the time of the invention. To that end, a combination of references cannot teach against, destroy or render useless what is already taught by a cited reference.

The issue of motivation can at times be difficult to assess and often requires the use of objective criteria to infer its existence or non-existence. To that end, proof of a long felt need to an existing or prevalent problem for a sufficient duration after the existence of certain prior art can be very probative.

It is believed that the obviousness rejection of Claims 3 and 52 based on the combination of Greenberg and Takahashi is moot based on the amendments to Claims 1 and 50, which incorporate the subject matter of now-canceled Claims 6 and 53, respectively. Therefore, Applicants now proceed with a traversal of the rejection of Claims 6 and 53 based on the combination of Takahashi, Greenberg, and Sakiyama et al.

Turning first to the Takahashi et al. reference, the Examiner believes that this patent adequately teaches a device that includes image splitting means for splitting an image of an object into right and left symmetrical image parts as well as image detecting means for detecting the stereo image parts and a single electronic imager

to permit focusing using focusing means along a single optical axis such that the views of the right and left parts overlap.

Applicants' agree in part, Takahashi et al., in each embodiment described therein utilizes a pair of lenses that brings a pair of images of an object that are relayed for focusing. The lens trains, however, are separated from one another by a horizontally disposed shielding plate. This requirement of this shielding plate is necessary with the parallel two lens train system, otherwise there will be considerable "image mixing" onto the single imager, yielding a mostly or completely unusable image. As such, this reference does not teach or describe, as opined out by the Examiner, that a single image is being split using a single optical system along a single optical axis. In such a system, no shielding plate is required, as the image splitting means (e.g., the refractive prism) creates a pair of image parts that are separately conveyed and focused onto the left and right halves of the imager and without image mixing. In spite of the embodiment wherein the instant patent teaches a single imager, as shown in Fig. 13, to receive the images from a single relay lens assembly, the image splitting means of Takahashi et al. in all facets of its teachings, still requires the use of at least two parallel optical structures, each passing only one of the stereo image parts, in order to gather two separate images of an object. This difference amounts to a considerable difference structurally from Applicants' invention in that every lens in the optical system carries both the right and left stereo image parts wherein the field of view of the object is split into these image parts using refraction or more particularly as recited according to independent Claim 1, an image splitting prism, rather than the physical spacing between two parallel, separate lens trains as described by Takahashi et al.

With regard to the Greenberg reference, this patent categorically describes an illumination system for use with a microscope, but does not refer to or suggest any form of use with an imaging system. The illumination system described therein includes a light source that is disposed in relation to a prismatic member that creates a pair of light beams from a single light beam, each of which are then directed to an objective. The Examiner has apparently made the argument that one could simply replace the lens system and the shielding plate of Takahashi et al. with the prismatic element of Greenberg in order to create a more compact system.

Applicants' disagree with this proposed combination for several reasons. As previously noted, Takahashi et al. clearly requires the use of a pair of parallel lens systems for each of its described embodiments in order to capture stereo image parts

that are conveyed to one electronic imager. The embodiment of Fig. 13, for example, requires a shielding plate that is used to prevent overlapping parts of the side by side images from being transmitted. Shielding plates would not be required if two separately spaced electronic imagers were to be used. Nowhere in this reference is there described utilizing a refractive splitting member and single optical train such as claimed herein. Takahashi et al can not claim this latter feature due to the existence of its parallel lens system structure.

With this understanding of the primary reference and turning to Greenberg, it is unclear how this reference can be used in conjunction with a two lens imaging system. Nowhere in the Greenberg reference is there any disclosure as to how the prism shown in Fig. 5, etc can be used for imaging purposes and therefore used as an image splitting means. Moreover, it is also not understood how one of ordinary skill in the field would have looked to Greenberg to make the inventive leap of Applicants of using a refractive prism for the purpose of splitting a field of view into two images in lieu of the teaching of Takahashi et al that requires two lens systems in order to obtain two separate images of the target and a shielding plate disposed therebetween. Applicants' herein submits that there is a substantial inventive gap that the Examiner is overlooking in making an apparent piecemeal combination of the references.

As to motivation found in the art to combine the references in the manner noted by the Examiner, Applicants' herein note that each of the cited references have been known prior art in excess of 10 years (since their issuance). If the motivation to combine were so prevalent to one of ordinary skill at the time of invention, it is opined given the need to make a more compact and less complex stereoscopic instrument that this combination would have been made long before Applicants'. To Applicants' knowledge, this combination has not been made. As a result, Applicants' respectfully submit that the long felt need to solving the problem of the present invention and the failure to apply the combination suggested by the Examiner to solve that problem appears to be objective evidence that there may not in fact be sufficient motivation for maintaining a prima facie obviousness rejection. To that end, therefore, it is believed that Greenberg and Takahashi are not combinable as the Examiner opines.

Turning to the reference of Sakiyama et al., the Examiner has not utilized this reference with regard to the subject matter of Claims 1, 2 or 3, but rather to those of Claim 6. Therefore, it is believed that Sakiyama et al does not contain any

features that add to the preceding arguments with regard to motivation. In fact, Sakiyama et al is similar to Takahashi in that this reference also refers to parallel lens systems that relay separate images but not to a refractive splitting member and single lens train. None of the secondary references to Miyano, Ko, or Hori appear to add, teach or otherwise suggest the above features. Therefore, Applicant believes the subject matter of Claims 2 and 3 combined with Claim 1, as well as Claims 51 and 52 combined with Claim 50, should be allowable over the prior art of record.

In arguendo, Applicant has further added the subject matter of Claims 6 and 53 to Claims 1 and 50, respectively. As to the Sakiyama et al reference, the Examiner has pointed to Fig. 4, for the proposition that the distal tip can include the image splitting features. One must consider the secondary references' teachings in their entirety. Sakiyama et al. illustrates therein a pair of lens trains, as well as other primary components of the endoscopic optical system. The present invention, on the other hand, merely requires the inclusion of the image splitting means (the prism) alone in the detachable distal tip. Applicant has already discussed the reasons why there is insufficient motivation to combine Takahashi et al and Greenberg. It is believed there is similar logic in why Sakiyama et al and Greenberg should not be combined. That is, all previous stereo systems have included dual lens systems for capturing separate images rather than to utilize a refractive prism to split a field of view of an object. Greenberg does not discuss the merits of utilizing the concepts of their illumination system for purposes of imaging. As such, its inclusion as stated by the Examiner is a matter of hindsight of the present invention given that there are certain inventive gaps that would have to be overcome in order to make this substitution. Moreover, and in the case of Applicant's invention, the use of a detachable tip including the prism, is one of an adaptive accessory. In the instance of Sakiyama, et al, however, the entirety of the imaging system is disposed within the tip. Therefore if the detachable tip were not included, an endoscope not having this attachment would no longer function. Claims 1 and 50 are believed to be allowable based on the foregoing comments and the amended claims. Reconsideration is respectfully requested.

It is believed that each of the remaining dependent Claims 5, 7, 8-10, and 54-57 are also allowable based on the preceding arguments. The recitation of Miyano, Hori et al, and Ko do not include any of the essential features or provide the motivation to combine Greenberg and/or Sakiyama et al and Takahashi so as to render the claims obvious. As a result, it is believed that Claims 7, 12, 13, and 55-

59 are also allowable for the same reasons. Reconsideration is respectfully requested.

In passing, Applicants' would like to discuss the merits of Claim 11, which has now been written in independent form. This claim, as amended, combines the previous claims (1 and 8) upon which it depended. The Examiner has rejected this claim based on the combination of Takahashi et al., and Sakiyama et al. The merits of Takahashi et al. relative to amended Claim 1 have already been discussed herein.

Claim 11 further recites that the individual stereo parts can be viewed on a display along with magnified portions of either of the images simultaneously. This concept of providing "zoom windows" in the display is highly advantageous. The recitation of Sakiyama et al. by the Examiner as providing this feature is not at all understood by Applicants'. The referred to portion at col. 8, lines 18-25, and Figs. 6(a), 6(b), 7(a) and 7(b) of the cited reference appears to refer to an arithmetic technique for image distortion/correction, but does not imply or teach any aspect that deals with simultaneous display of any portion of the image parts with various magnifications. For these reasons, it is respectfully requested that Claim 11 is allowable over the prior art of record and the rejection should be withdrawn.

Applicant has also made Claims 14, 15, 16, 17, 24-27, 39, 45, 46, 60, 69, 78, and 85 independent, combining the features of the preceding claims upon which each claim depended. Because the essential features contained in each of the above claims and those claims dependent thereupon are missing from the cited prior art, taken either alone or in combination, there cannot be a suitable rejection under the Statute. As a result, these rejections should be withdrawn and reconsideration is respectfully requested.

Turning to the Section 112 rejection, the Examiner has rejected Claim 16 under second paragraph for indefiniteness. Applicant herein has amended this claim to remove the terminology "is effective for" in favor of more definite language with regard to the use of the plurality of probes. Applicant has also amended Claim 57 in order to correct a grammatical error. No new matter has been added. It is believed these claim amendments cure the outstanding rejection and withdrawal of same is therefore respectfully requested.

Applicants' gratefully acknowledge the acceptance of the formal drawings received on February 4, 2004.

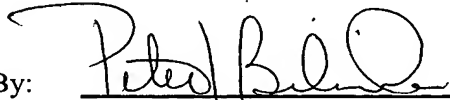
In summary, it is believed the above-captioned patent application is now in allowable condition and such allowance is earnestly solicited.

If the Examiner wishes to expedite disposition of the above-captioned patent application, he is invited to contact Applicants' representative at the telephone number below.

The Director is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-0289.

Respectfully submitted,

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